

REMARKS

In the Office Action, the Examiner objected to claim 6 because of informalities. Claims 1-6, 13-15 and 19 were rejected under 35 U.S.C. 102(b) as being anticipated by United States Patent No. 4,027,993. Claim 10 was rejected under 35 U.S.C. 102(b) as being anticipated by United States Patent No. 4,027,993 as evidenced by United States Patent No. 5,609,468. Finally, claims 7, 8 and 16-18 were rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent No. 4,027,993 in view of United Kingdom Patent Application GB 2,058,218 A.

The Examiner has objected to claims 1-6, 13-15 and 19 as being anticipated by U.S. Patent No. 4,027,993 (herein Wolff). Applicant respectfully disagrees with this objection and to facilitate the Examiner's favorable reconsideration have amended claim 19 by including the term "pre-established".

Wolff relates to a method and apparatus for the isothermal compression of gaseous fluids. A gaseous fluid to be compressed is mixed with a coolant liquid to form foam. The foam is compressed using standard technologies and the heat generated by the compression of the gaseous fluid is absorbed by the coolant liquid. After compression, the two components are then separated and the liquid can be cooled and reused as coolant liquid in the isothermal compression of further gases.

Wolff does not pump a pre-existing multi-phase fluid flow but rather relates to a method for the isothermal compression of a gas using an entrained liquid coolant in the form of foam. It does not disclose bleeding a compressed multi-phase fluid flow from an outlet of a pump back into the multiphase flow at the inlet upstream of a pump. Injection is occurring in a liquid phase flow at the inlet of the pump and no gas is injected. Also, the object of Wolff is not to ensure the efficient

pumping of a multiphase fluid flow as in the present invention but rather to provide an isothermal gaseous compression technology. The way in which the object is achieved is to deliberately create a multiphase flow. The present invention relates to improvements in pumping of a multiphase flow where previously it was desirable to separate the phases prior to pumping to overcome problems in the pumping of multiphase fluids.

In particular it is noted that bleed line 98 referred to by the Examiner is intended for the transfer of liquid from a pressure tank to a foam chamber 94 where it can be entrained with a gas to form the foam. This creates the multiphase fluid flow whereas in the present invention the multiphase fluid flow is pre-existing and the bleed line is used to partially pre-pressurize the multiphase fluid flow upstream from the centrifugal compressor. Furthermore, the bleed line can be used to inject the pressurized multiphase fluid back into the inlet and add a rotational force to the multiphase fluid flow at the inlet. The present invention bleeds a mixture of the liquid and gaseous components of the multiphase fluid whereas the Wolff disclosure only bleeds the separated liquid component of the foam, and then injects it only into the liquid inlet line.

In light of this independent claims 1 and 13 and amended claim 19 are novel over Wolff. Dependent claims 5, 6, 14 and 15 are novel for the reasons discussed above with respect to independent claims 1 and 13 and for the additional features recited therein.

Applicant also respectfully traverses the Examiner's rejection of dependent claim 10 as anticipated by Wolff in light of U.S. Patent No. 5,609,468 (herein Burgess) and reiterates Applicant's comments made above with respect to independent claim 1 upon which claim 10 is dependent. Dependent claim 10 is novel for the reasons recited in independent claim 1 and for additional features recited therein.

The Examiner has also rejected dependent claims 7 to 8 and 16 to 18 as being obvious in view of Wolff in combination with GB 2,058,218 (herein Holzhüter). Applicant respectfully traverses this objection.

As a preliminary point applicant reiterates the comments made above with respect to differentiating the subject matter of independent claims 1 and 13, upon which claims 7, 8 and 16-18 depend, from the disclosure of Wolff.

Furthermore applicant notes that the present invention addresses the problems in the art of pumping multiphase fluid flows in which the gas phase separates from the liquid phase and coalesces in large gas pockets at the blade entry throat causing surging and choking of pumps.

The present invention addresses these difficulties by using a bleed line to transfer pressurized multiphase fluid from the outlet of the centrifugal pump to the inlet upstream from the pump. This has the effect of pre-pressurizing the inlet stream and reducing the aforementioned difficulties.

Wolff does not address this problem as it is concerned with the isothermal compression of a gaseous fluid using an entrained liquid coolant. The bleed line of Wolf is used for recycling the liquid coolant and does not transfer a multiphase fluid as in the present invention.

Holzhüter describes a bleed flow between the volute casing of a pump rather than between an outlet pipe and an inlet pipe upstream of a pump. As such the teaching of Holzhüter is not retrofitable, a benefit that is inherent with the current invention.

For these reasons together with the reasons discussed above with respect to novelty, applicant submits that claims 7, 8 and 16-18 are not rendered obvious by the disclosure of Wolff in light of Holzhüter.

Based on the foregoing amendments and remarks, it is respectfully submitted that the claims in the present application, as they now stand, patentably distinguish over the references cited and

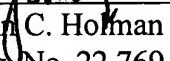
applied by the Examiner and are, therefore, in condition for allowance. A Notice of Allowance is in order, and such favorable action and reconsideration are respectfully requested.

However, if after reviewing the above amendments and remarks, the Examiner has any questions or comments, he is cordially invited to contact the undersigned attorneys.

Respectfully submitted,

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